

## Comparison of neutral temperature with ion temperature in the polar lower thermosphere

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We will present results of comparison between the neutral temperature and the ion temperature at 100-110 km height above Tromsø (69.6°N, 19.2°E), Norway. We have conducted observations of the neutral temperature and the sodium density between about 80 and 110 km with the sodium LIDAR at Tromsø since October 2010. We have also obtained wind data by making five directional observations since October 2012. To date, we have obtained temperature and sodium density data for about 2800 hours in total and about 1800 hours of wind data. For five winter observational seasons between 2010 and 2015, simultaneous observations of the sodium LIDAR and the EISCAT UHF radar were conducted at altitudes between 100 and 110 km for 43 nights (about 250 hours).

Below 150 km in altitude at middle latitudes, due to collisions between the two species as well as absence of external heat sources, the ion temperature is thought to be almost the same as the neutral temperature. This is not the case in the polar lower thermosphere because of the energy input from the magnetosphere. Major heat sources are Joule heating, auroral particle heating, and the electron-ion heat exchange. Among them, Joule heating is the strongest component in the lower thermosphere. To evaluate contributions of these heat sources, as the first step, we have compared the neutral temperature obtained by the sodium LIDAR with the ion temperature by the EISCAT UHF radar at altitudes between 100 and 110 km. In general, at and below about 105 km there seems to be a reasonable agreement between the temperatures, and the ion temperature tends to be higher than the neutral temperature with increasing height above 105 km. We will present the comparison results and also discuss the effect of the Joule heating.

Keywords: sodium lidar, EISCAT radar, joule heating, atmosphere temperature, polar lower thermosphere